Status Report

1999 - 2000

Black-tailed Prairie Dog Monitoring at Scott's Bluff National Monument

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INTRODUCTION

Black-tailed prairie dog (Cynomys ludovicianus, BTPD) historically occupied over 100 million acres of shortgrass and mixed-grass prairie in 11 western states (National Wildlife Federation 2000a). Currently less than one percent of this habitat remains occupied, 700,000 to 800,000 acres. The dramatic decline in BTPD habitat and abundance is the result of changing land use patterns, habitat fragmentation, disease, shooting, and poisoning (U.S. Fish and Wildlife Service 2000). Sylvatic plague (Yersinia pestis), introduced from Europe and first identified in prairie dog populations in the mid-1930's (Hubbard 1947) is capable of causing massive die-offs in prairie dog populations (Barnes 1993, Cully 1993). Wide spread control of prairie dogs through shooting and poisoning is still being practiced in most states. Most states require the eradication of the species on private and publicly held lands at the expense of the landowner (Desmond et al. 2000).

Concerns over the elimination of the BTPD from prairie ecosystems, prompted National Wildlife Federation (NWF) personnel to petition the U.S. Fish and Wildlife Service (FWS) to list the species as threatened throughout its range (Graber et al. 1998). In February 2000 the FWS ruled that the BTPD warranted listing as a threatened species under the Endangered Species Act of 1973 (National Wildlife Federation 2000b). However, they failed to list the BTPD as a threatened species because of an overabundance of other species that are higher-priority candidates for listing. The FWS will review its decision on listing the species annually. Species dependent on the BTPD for food or the habitat they produce include the Burrowing owl (Athene cunicularia), Mountain plover (Charadrius montana), Kit fox (Vulpes velox), and Ferruginous hawk

(Buteo regalis) (National Wildlife Federation 2000c). These species are candidates or potential candidates for listing as threatened species under the Endangered Species Act of 1973. America's most endangered mammal; the Black-footed ferret (Mustela nigripes) is wholly dependent on the prairie dog for its survival (National Wildlife Federation 2000c).

Encouraged by the FWS recognition of the BTPD as a species warranting listing as threatened, the NWF has identified five main points for conserving and recovering the BTPD nation wide. These points include: 1) development of recovery and conservation plans for the species that set and achieve clear population objectives and support healthy grassland ecosystems, 2) reclassifying the BTPD as wildlife, not pests or vermin, and managing the species accordingly, 3) adopting and enforcing regulations on the shooting of BTPD once the species is recovered, similar to other wildlife species, 4) developing and implementing inventory and monitoring programs, and 5) supporting research on Sylvatic plague. Similar concerns for recovering the BTPD to stable numbers on National Park Service (NPS) lands has prompted the Park Service to identify parks and monuments within the historic range of the BTPD that still host populations of prairie dogs. Seven of the 29 parks or monuments within the historic range of the BTPD still maintain populations (Badland's National Park, SD; Bent's Old Fort National Historic Site, CO; Devil's Tower National Monument, WY; Fort Larned National Historic Site, KS; Scott's Bluff National Monument, NB; Theodore Roosevelt National Park, ND; and Wind Cave National Park, SD).

History of Scott's Bluff National Monument's Black-tailed Prairie Dog Colony

The colony of BTPD at Scott's Bluff National Monument, Nebraska (SCBL) was reestablished in 1981 from vagrant individuals moving onto the monument. Black-tailed

prairie dogs had been exterminated from the monument in 1944. Pursuant with Nebraska state law requiring BTPD be controlled (repealed, 1995), early research at SCBL centered on controlling BTPD numbers and mitigating any potential threat they posed to a cultural resource of the monument, the Oregon Trail, its native prairie, or adjacent private lands (Franklin 1984). Franklin (1984) treated part of the population with diethylstilbestrol, a chemosterilant, thus curtailing reproduction by all females in the treated area. Three females in the untreated area produced a total of 13 pups. In 1985, monument personnel removed fifty BTPD from a population estimated at 107 individuals (Cox and Franklin 1989). The overall BTPD population was experimentally reduced again in the fall of 1986, spring of 1987, and summer 1988 by 36%, 47.5%, and 12% respectively (Cox and Franklin 1989). Franklin (1984) and Cox and Franklin (1989) used mark and recapture techniques to estimate population sizes for BTPD. Monument personnel monitored the population size from 1989 though 1993, exception 1992. Additional population reductions were not conducted during this period. Colony size, population densities, and estimates of overall abundance of BTPD at SCBL from 1981 through 1994 are given in Table 1.

Data collected previously indicate that this population may have experienced one or more episodes of Sylvatic plague in the recent past. During 1988, the last year of any known population control efforts, the population was estimated at 219 individuals (Cox and Franklin 1989). By 1991 the population was at 27 individuals and by 1995 had reached an all time low of 20 individuals. The rapid and sustained decline in BTPD numbers between 1988 and 1995 could be the result of several factors including illegal shooting or poisoning, poor winter survival, or predators. However, the susceptibility of

the BTPD to Sylvatic plague can't be ignored as a potential factor depressing the population at SCBL in the early- to mid-1990s. Sylvatic plague has been reported as occurring in western Nebraska, the area of the state where SCBL is located (Kowles 1998). Plumb et al. (2001) state that the consequence of Sylvatic plague on a BTPD colony is massive to near complete mortality with slow or negligible recovery.

Beginning in 1995, BTPD were monitored through a joint effort of the NPS and the Biological Resources Division (BRD) of the U.S. Geological Survey. A peer-reviewed monitoring protocol is the result of this endeavor. Currently, park personnel and the Prairie Cluster Long-Term Ecological Monitoring Program (PC-LTEM) of the National Park Service monitor BTPD abundance and presence of Sylvatic plague within the colony. This report describes monitoring results for years 1999 and 2000. This report also provides an overview of the BTPD colony since 1983.

OBJECTIVES

The objectives of BTPD monitoring at SCBL is to: 1) estimate BTPD population abundance; 2) map annual size and location of the BTPD colony; and 3) determine through observation if Sylvatic plague (Yersinia pestis) is present in the BTPD colony.

METHODS

Black-tailed Prairie Dog Density and Abundance

Plumb et al. (2001) detail the current monitoring methods used to estimate BTPD densities, abundance and colony size. The entire BTPD colony at SCBL was observed from one viewing stand in 1999 and 2000. Eight replicate counts, with 15 minute

intervals between the start of each replicate, were made on each of three days, August 24 - 26, 1999 and August 2, 3, and 5, 2000. Surveys were conducted between 6:30 – 10:30 am on mornings with no precipitation, temperatures > 10 ^{O}C (50 ^{O}F) and wind speeds < 32 kph (20 mph).

Using the visual count data, two calculations were made to estimate annual BTPD density and abundance within the colony at SCBL.

Density (P) = ([Y / Sp] – 3.04) / 0.40, where Y is the maximum count of individuals in a replicate over the three day survey period and Sp the total area sampled.

Abundance (T) = (Sc)(P), where Sc is the total colony size in hectares and P the estimated density per hectare.

A 95 % confidence interval was calculate for density and abundance using the following formulas:

Density lower limit, P = P – 1.96 [SE(P)]

Density upper limit, P = P + 1.96 [SE(P)]

Abundance lower limit, T = T – 1.96 [SE(T)]

Abundance upper limit, T = T – 1.96 [SE (T)], where SE is the standard error for Density (P) and Abundance (T), respectively. Standard error (SE) is derived by first calculating Variance (P) = 66 + 0.025 $(P – 18.4)^2$ for Density (P) or Variance (T) = 66 + 0.025 $(T – 18.4)^2$ for Abundance (T) and than calculating SE (P or T) = √ Variance (P or T).

Black-tailed Prairie Dog Colony Mapping

Boundaries of active burrows and active clip line on the BTPD colony at SCBL were delineated in both years, using a Global Positioning System in conjunction with a

PC-based Geographic Exploration Systems, ArcView™. Burrows were classified as active if burrow openings were > 7 cm in diameter, the burrow was within 5 m of an active clip line, and fresh scat was observed within 0.5 m of the opening. Burrows were not classified as active if there were spider webs across an opening or unclipped vegetation growing in or around the opening (Biggins et al. 1993, Desmond et al. 2000). Colored pin flags were used to mark the active burrows on the perimeter of the colony and delineate the perimeter of the active clip line prior to GPS mapping. In most cases the active clip line was easily distinguishable. However, when an active clip line was not apparent, the extent of the active burrow closest to clipped vegetation was mapped. Areas of un-grazed vegetation within the colony were excised from the active clip line mapping to minimize the amount of un-occupied grassland included in colony size estimates. Boundaries were walked in their entirety regardless of which mapping technique was employed in order to close the colony polygons.

Colony size was determined by combining the greatest extent of both active burrows and active clip line. The two parameters were combined in order to map the largest extent of active colony perimeter. As a rule, the mapping of both parameters produces varying yet statistically similar estimates of colony size (Plumb et al. 2001). Therefore, combining both active burrows and active clip line within years gives a more robust measure of colony size.

Sylvatic Plague Surveillance

Park personnel monitor Sylvatic plague presence within the BTPD colony at SCBL throughout the year. Observation of a substantial die-off in the population during the year alerts park personnel to contact appropriate authorities who verify the presence

or absence of Sylvatic plague. Sylvatic plague was not observed in the BTPD population during the current monitoring effort.

Vegetation Monitoring

Vegetation monitoring was not done on the BTPD colony at SCBL during this study. However, monitoring vegetative changes within the BTPD colony may be desirable when resources allow for it. Knowledge of vegetative changes brought about by BTPD grazing would allow for better management of the prairie dog and monument resources influenced by their presence. Vegetation monitoring would also allow us the opportunity to annually assess the accuracy of population density and abundance estimators related to vegetative obstructions during visual counts of the BTPD population.

RESULTS

Black-tailed Prairie Dog Density and Abundance

The results of BTPD monitoring in 1999 and 2000 are given in Figures 1 – 3, along with the previous four years. Density of BTPD declined by 6.0 individuals / ha between 1998 and 1999 and 7.5 individuals / ha between 1999 and 2000. Since 1997, annual BTPD densities have under gone a steady decline averaging 6.6 individuals / ha / year, 68% overall (Figure 1). However, the estimated BTPD population has increased an average of 26 individuals / year since 1995. In 1999, the largest population estimate under the current monitoring protocol was recorded, 175 individuals. A moderate decline of 26 individuals occurred between 1999 and 2000.

Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the BTPD colony at SCBL between 1995 and 2000 are shown in Figures 3. Based on colony mapping, colony size was unchanged at 1.4 ha during the first two years of monitoring under the current protocol, but has steadily increased since 1996. Colony size increased by 7.2 ha between 1998 and 1999 and 5.7 ha between 1999 and 2000. BTPD colony sizes in 1999 (10.5 ha) and 2000 (16.2 ha) were the largest every reported for SCBL. Mapping in year 2000 demonstrated the BTPD colony at SCBL has increased by a factor of 10.6 since 1995 – 1996, with an average annual rate of increase of 3.7 ha.

DISCUSSION

Recent declines in the density of BTPD at SCBL reflect recent colony expansions and are not indicative of a significant decline in overall population size. Population sizes in 1999 and 2000 were the highest recorded under the current monitoring effort. At the same time colony sizes were the largest ever recorded for this population. It appears that the BTPD population is expanding rapidly outward while at the same time they are abandoning areas at the center of the colony. Other researchers (Garrett and Franklin 1988, Hoogland 1995) have reported similar findings and suggest that as vegetation becomes overgrazed in the center of the colony, the colony expands outward to take advantage of more palatable grasses. These areas of palatable grasses surrounding a colony's center are referred to as colony expansion zones (Garrett and Franklin 1988). In years 1999 and 2000 observers noted that interior portions of the colony were indeed unused by BTPD and overgrown with sweet clover (Melilotus spp.). These unused

sections of the colony were excluded from the colony size estimates. However, much of this vegetation was of sufficient height to partially obstruct the view of other sections of the colony. It was estimated that as much as 20-30 percent of the colony was not easily surveyed in 1999 and 2000 due to obstruction from topography and vegetation. Therefore, actual population sizes may have been higher thus density estimates would also be higher. However, density estimates have not changed significantly at anytime since 1995, the year monitoring of the BTPD population at SCBL was started under the current protocol.

In future years, positioning the observation tower(s) in a central location(s) will aid observers in viewing the entire colony during surveys. Colony mapping in 2000 (Fig. 3) has shown that the colony has reach a size and complexity sufficient to require it being divided into sections for BTPD counts. Plumb et al. (2001) recommend conducting a visual count on a single 200 x 200-m section of a colony. However, the unique crescent shape of the BTPD colony at SCBL and its variations in population densities across areas of the colony may dictate dividing the colony into two or more sections for visual counts. Two or more observation towers may then be required if one centrally located stand is not sufficient for observing the various sections of the colony. If the colony continues to grow, both sectioning the colony and using two or more observation towers will be implemented in an effort to efficiently count BTPD numbers.

Presently, colony expansion seems to have involved only a small portion of the monument, 2% of the monument's 698-ha of grassland. However, future expansions of any significant amount in the present colony seem unlikely due to barriers curtailing BTPD dispersal. The south and a portion of the east side of the colony is bounded by

ridges created when wind blown sediment was deposited along fence lines. Expansion to the west of the colony would be halted by a fence line and actively cultivated private croplands. To the north the colony is bounded by a large irrigation canal that will precluded any colony expansion in that direction. In recent years the colony has expanded to the east, a trend that may continue until the colony reaches a north-south oriented ditch. With intra-colony expansion limited, inter-colony dispersal could occur. Therefore, monument personnel need to be aware of the potential for BTPD dispersal and monitor the monument for new colonies annually. Black-tailed Prairie Dog dispersal from the current colony should begin in late winter and be complete by the end of June (Garrett and Franklin 1988). Thus monitoring for new colonies from early spring through the last week of June will allow for the identification of new colonies and the opportunity to minimize any damage to the monuments primary cultural resource, the Oregon Trail.

Vegetation monitoring should be undertaken to help in understanding the ecology of BTPD and help in managing their population at SCBL. Knowledge of vegetative changes brought about by BTPD grazing will allow resource managers to anticipate impacts BTPD may have on native prairie within the monument if the current colony continues to expand and/or additional colonies become established. Knowledge of the vegetation utilized by BTPD will also let monument personnel assess areas at SCBL where BTPD relocations may be feasible or even desirable. If the FWS list the BTPD or any of its associate species as threatened or endangered then expansion of the population may become critical for aiding in the recovery of any or all of these species. Knowledge of the vegetative preferences of BTPD will allow resource managers to assess the likelihood that they will disperse into the Oregon Trail. Vegetation monitoring would

also allow researcher to estimate the percent of the colony obstructed from view during BTPD counts. This in turn would allow for the opportunity to assess the accuracy of our BTPD population density and abundance estimators.

While Sylvatic plague was not observed in the BTPD population during the current monitoring effort, monitoring for its presence will continue. Some evidence indicate this population may have succumbed to Sylvatic plague one or more times in the recent past, justifying this monitoring effort. Both the small population sizes of the early- and mid-1990's and reports of Sylvatic plague in prairie dogs in western Nebraska (Knowles 1998) suggest the presence of plague in the BTPD population at SCBL is likely. However, the rapid and sustained decline in BTPD numbers between 1988 and 1995 may have resulted from illegal shooting or poisoning, poor winter survival, or predators and this should be investigated if future declines occur. If Sylvatic plague is found to be a factor that sporadically depresses BTPD numbers at SCBL in the future, the monument may lose this element of its natural resources. Massive to complete mortality of BTPD often accompanies Sylvatic plague outbreaks (Plumb et al 2001). Knowles (1998), suggest that many of the abandoned prairie dog colonies in western Nebraska are the result of Sylvatic plague.

For reasons already outlined, BTPD monitoring at SCBL should continue with the need for two observation towers during visual counts likely. Annual mapping of the colony will allow resource managers the opportunity to assess the impacts of colony expansions on the cultural and natural resources of the monument. Sylvatic plague surveillance as well as the surveillance for other mortality factors should continue to be a routine part of the assessment of the BTPD colony at SCBL. Surveillance of mortality

factors must be undertaken if a rapid decline in the BTPD population is observed in the future. Vegetation monitoring should be included in the annual surveys of the colony if the potential for habitat use in other parts of the Monument is of concern. Vegetation monitoring should also be undertaken if it is felt that it is need to accurately estimate BTPB densities and abundance. Findings from this monitoring effort on BTPD at SCBL should be incorporated with those from other National Park Service lands in order to help recover this element of the prairie ecosystem to sustainable numbers.

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Table 1. Colony size, population density and number of individual Black-tailed Prairie Dogs at Scott's Bluff National Monument, Nebraska between population reestablishment and 1994. Sources of annual data are shown also.

Year	Area (ha)	Density (individuals/ha)	Population Size	Source
1981	Colony Reestablishment in Scott's Bluff National Monument			
1982	n/a	n/a	n/a	None
1983	0.98	76.5	75	Franklin 1984
1984	1.31	30.5	40	Franklin 1984
1985	n/a	n/a	107	Cox and Franklin 1989
1986	5.77	34.7	200	Cox and Franklin 1989
1987	5.14	58.9	303	Cox and Franklin 1989
1988	3.39	64.6	219	Cox and Franklin 1989
1989	n/a	n/a	62	Monument Personnel unpub.
1990	n/a	n/a	62	Monument Personnel unpub.
1991	n/a	n/a	27	Monument Personnel unpub.
1992	n/a	n/a	n/a	None
1993	n/a	n/a	45	Monument Personnel unpub.
1994	n/a	n/a	n/a	None

Figure 1. Estimated Black-tailed prairie dog densities at Scott's Bluff National Monument, Nebraska for years 1995 to 2000. Bars at each annual density estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their density estimate are not significantly different.

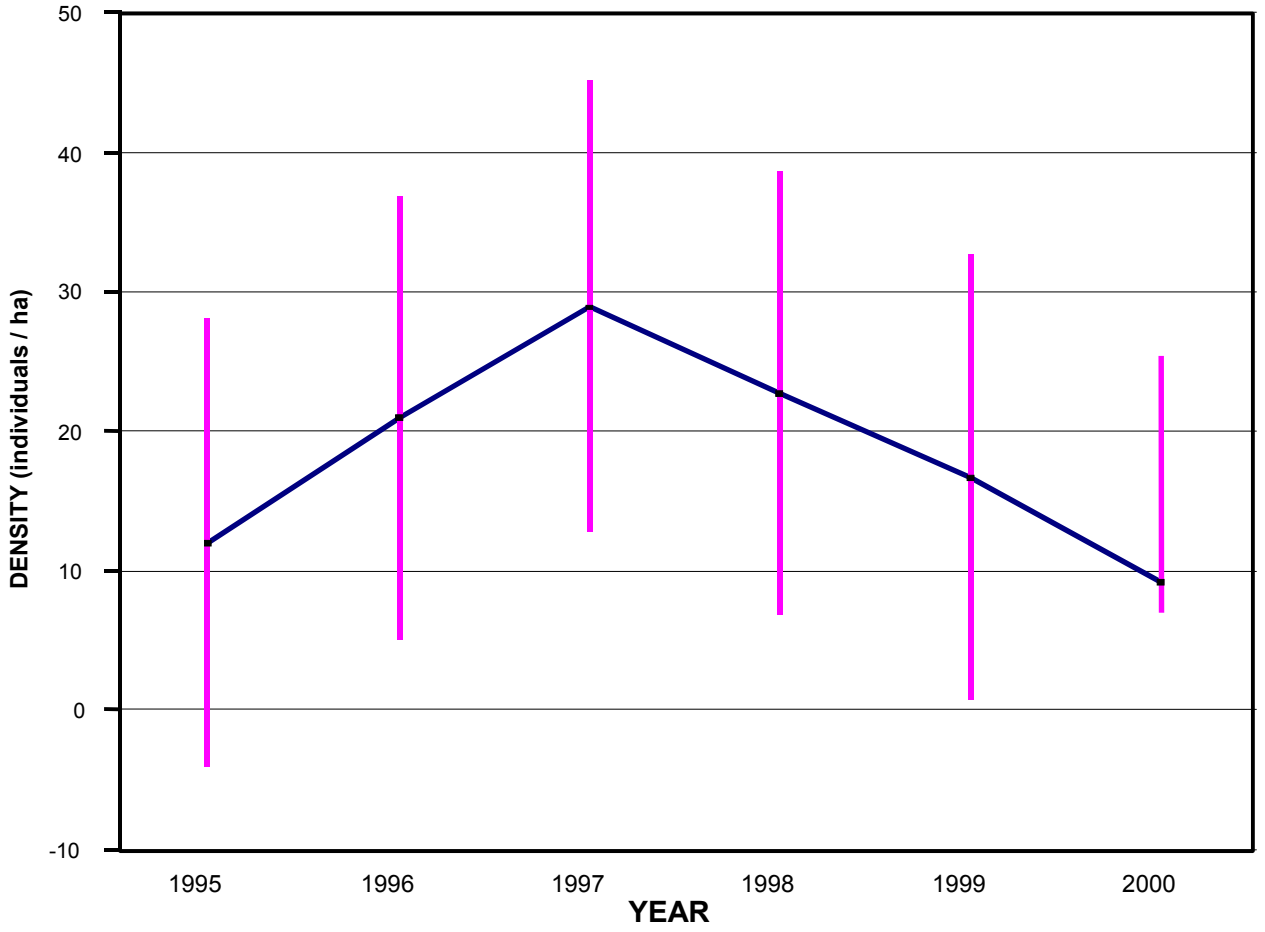

Figure 2. Estimated Black-tailed prairie dog populations at Scott's Bluff National Monument, Nebraska for years 1995 to 2000. Bars at each annual population estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their population estimate are not significantly different.

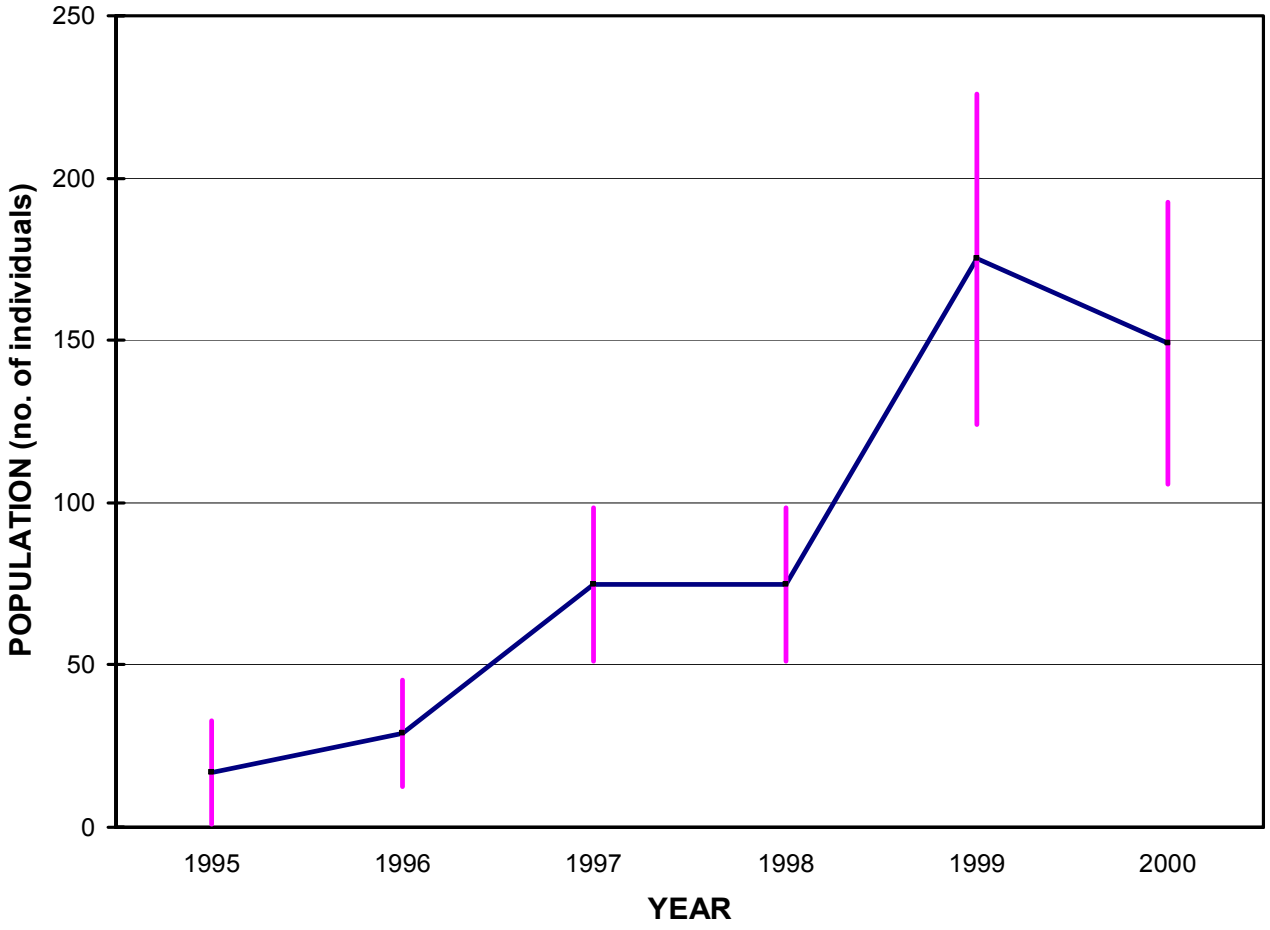

Figure 3. Changes in Black-tailed prairie dog colony sizes and shape at Scott's Bluff National Monument, Nebraska for years 1995 to 2000, exception 1996.